

# Contents

<b>Preface</b>	<b>ix</b>
<b>Abbreviations</b>	<b>xi</b>
<b>Introduction</b>	<b>1</b>
Types of Problems Considered, 2	
Description or Interpretation?, 7	
<b>1. Preliminaries</b>	<b>11</b>
1.1. Random Functions, 11	
1.2. On the Objectivity of Probabilistic Statements, 22	
1.3. Transitive Theory, 24	
<b>2. Structural Analysis</b>	<b>29</b>
2.1. General Principles, 29	
2.2. Variogram Cloud and Sample Variogram, 34	
2.3. Mathematical Properties of the Variogram, 57	
2.4. Regularization and Nugget Effect, 74	
2.5. Variogram Models, 80	
2.6. Fitting a Variogram Model, 104	
2.7. Variography in Presence of a Drift, 115	
2.8. Simple Applications of the Variogram, 128	
2.9. Complements: Theory of Variogram Estimation and Fluctuation, 137	
<b>3. Kriging</b>	<b>150</b>
3.1. Introduction, 150	
3.2. Notations and Assumptions, 152	

3.3.	Kriging with a Known Mean, 154	
3.4.	Kriging with an Unknown Mean, 164	
3.5.	Estimation of a Spatial Average, 193	
3.6.	Selection of a Kriging Neighborhood, 201	
3.7.	Measurement Errors and Outliers, 210	
3.8.	Case Study: The Channel Tunnel, 215	
3.9.	Kriging under Inequality Constraints, 224	
<b>4.</b>	<b>Intrinsic Model of Order <math>k</math></b>	<b>231</b>
4.1.	IRF-0 and IRF- $k$ , 231	
4.2.	A Second Look at the Model of Universal Kriging, 233	
4.3.	Allowable Linear Combinations of Order $k$ , 236	
4.4.	Intrinsic Random Functions of Order $k$ , 243	
4.5.	Generalized Covariance Functions, 252	
4.6.	Estimation in the IRF Model, 265	
4.7.	Generalized Variogram, 276	
4.8.	Automatic Structure Identification in the General Case, 281	
<b>5.</b>	<b>Multivariate Methods</b>	<b>292</b>
5.1.	Introduction, 292	
5.2.	Notations and Assumptions, 293	
5.3.	Simple Cokriging, 296	
5.4.	Universal Cokriging, 298	
5.5.	Case of Gradient Information, 313	
5.6.	Multivariate Random Functions, 321	
5.7.	Shortcuts, 351	
5.8.	Space-Time Models, 362	
<b>6.</b>	<b>Nonlinear Methods</b>	<b>375</b>
6.1.	Introduction, 375	
6.2.	Simple Methods for Estimating a Point Distribution, 376	
6.3.	Local Estimation of a Point Distribution by Disjunctive Kriging, 388	
6.4.	Simple Methods for Estimating a Block Distribution, 419	
6.5.	Local Estimation of a Block Distribution by Disjunctive Kriging, 437	

<b>7. Conditional Simulations</b>	<b>449</b>
7.1. Introduction and Definitions, 449	
7.2. Direct Conditional Simulation of a Continuous Variable, 462	
7.3. Conditioning by Kriging, 465	
7.4. Turning Bands, 472	
7.5. Nonconditional Simulation of a Continuous Variable, 478	
7.6. Nonconditional Simulation of an IRF- $k$ , 506	
7.7. Simulation of a Categorical Variable, 520	
7.8. Object-Based Simulations: Boolean Models, 545	
7.9. Constrained Simulations, 561	
7.10. Practical Considerations, 571	
7.11. Case Studies, 577	
<b>8. Scale Effects and Inverse Problems</b>	<b>593</b>
8.1. Introduction, 593	
8.2. Upscaling Permeability, 594	
8.3. Stochastic Differential Equations, 602	
8.4. Inverse Problem in Hydrogeology, 611	
<b>Appendix</b>	<b>636</b>
<b>References</b>	<b>650</b>
<b>Index</b>	<b>687</b>